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## AUTUMN MEETING OF THE OHIO STATE HORTICULTURAL SOCIETY

LITTLE HOCKING, SEPTEMBER 17, 1909

STATE FAIR MEETING, 1909

On account of the regular midseason meeting which was being advertised for September 17th, the State Fair Meeting was but an informal session, no program having been arranged. The members of the Executive Board were required to meet at this time, however, as the secretary's tenure of office had expired on the first day of August, 1909. The result of the Board Meeting was that F. H. Ballou was re-elected secretary for the ensuing year.

A standing committee was appointed, consisting of Messrs. W. J. Green and F. H. Ballou, for the purpose of endeavoring, if possible, to solve a number of problems relating to nomenclature of varieties of apples which have been causing confusion among exhibitors at the State Fair for a number of years.

### AUTUMN MEETING AT LITTLE HOCKING, SEPTEMBER 17, 1909

This was one of the most excellent and successful midseason sessions in the history of the society. The meeting was held in conjunction with the Little Hocking Grange in the orchard of Mr. Chas. W. Oakes, three and one-half miles below Little Hocking, on the Ohio River. While this point was considered somewhat inaccessible because of its distance from the railroad station, and some doubt as to attendance seemed to exist, it proved that all uneasiness on this point had been quite unwarranted. The day chosen was perfect, and the boat which had been chartered at Parkersburg, W. Va., especially for the occasion, carried down the beautiful Ohio River, soon after sunrise, a generous company of enthusiastic, appreciative horticulturists who were out for what might be learned at the meeting.

Aside from the boat load of excursionists, the residents of southern and western Washington County turned out in goodly number, many driving several miles to attend the meeting. A number of horticulturists from distant parts of the state was in attendance. It was estimated that there were present 500 persons—all interested in the wonderful results in fungus and insect control that had been wrought by the horticultural department of the Experiment Station in Mr. Oakes' orchard.

The large, 34 year old Rome Beauty apple trees of this orchard, where thorough spraying had been done, were heavily laden with large, smooth, sound, perfect apples while the unsprayed trees in the same orchard, and all orchards which had not been sprayed throughout the neighborhood and all that part of Ohio were producing only meagre crops of miserably small, scabby, wormy worthless fruit. It was a demonstration long to be remembered and one that will prove productive of a great awakening as to the possibilities of apple culture in south-eastern Ohio. The following papers were presented:

#### SPRAYING FOR THE FUNGOUS DISEASES OF THE APPLE AND OTHER CROPS

By A. D. SELBY, Ohio Experiment Station

"What is a fungus disease?" will be often asked in connection with such a title or with titles referring to diseases of plants caused by parasitic fungi. Around one's views or understanding, or, I might say, one's apprehension or grasp upon ideas of parasitism and the resultant effects of it upon the host crop or plants, we must group the opposed or opposing forces of our remedies, such as spraying, seed treatments, selection of resistant and relatively immune sorts and other possible agencies for the prevention or amelioration of crop losses through fungus diseases.

Should you ask me about my notion as to fungus diseases, I might reply that succinctly they are diseases produced in plants as a result of the attacks of parasitic fungi or bacteria. Further, these diseases are characterized by the way the parasite is propagated and scattered, which is usually through spores of microscopic size, and by any conveying agency, such as winds, movements of insects, animals or even of man. Further, that these diseases are not only favored or held back by reason of the special characters of the host plant, such as relative liability or immunity in being attacked, but also that other things being equal, these diseases are enormously swayed or controlled by the conditions existing, at any point, with respect to the moisture, especially that held as air humidity and by the temperature of the air which surrounds both the crop or host plant and the attacking parasitic form.

Our host plants, our crops have their optimum of moisture, temperature, etc. Their parasites have a very similar and often analogous and inter-related optimum of these very same conditions.

Viewing these processes of parasitic attack from the objective of their possible control, what is the basal principle, or what are the means to this end?

Inevitably there will be two viewpoints, viz.: 1. That of the plant or crop diseased, and 2. That of the parasitic fungus or bacterium. We are most concerned today with the side of checking the parasitic fungi which attack the apple, the potato and tomato and possibly the muskmelon. Upon the crop we must not inflict more injury than the parasite would have done. As to checking the parasite we must have a principle which is the basis for action. What is this principle? My friends, each of you formulate it in your own minds as I ask each one.

No simple formulation is without objections. I like this one: Disinfection of the crop. The principle of parasitic disease prevention through spraying rests upon the same basis as the treatment given to rooms in which patients have been ill from diphtheria, scarlet fever and smallpox. Both seek to kill, to destroy the spores or other propagating parts of the parasites—that is, to destroy the microbes, the conveying germs of the disease. I emphasize this matter of the

principle of disinfection by the use of fungus killing substances, called fungicides, because our mutual understanding of this matter rests upon the principle and the further fact that these spray or seed treatment substances will destroy the spores and other living parts of these fungi. It is not the moonshine, the weather or the presence of something away outside we are fighting. It is a number of actual living parasites which cause our losses. Although we may never forget that the moisture and temperature of weather conditions are of very great influence, these influence these diseases only as they favor the development of the parasite out of proportion to their influence on the host crop. When this happens the return from the host plants is disappointing to the grower.

#### THE USEFUL FUNGICIDAL SPRAYS

When we have infection through the spores or other parts of these parasites we are called upon to treat for the parasites. The disinfectants or sprays used on our crops are of different composition. For use on crops or trees in foliage the most used fungicides contain copper compounds as the active agent—Bordeaux Mixture, Bordeaux and Iron Sticker, Ammoniacal Copper Carbonate and Soda Bordeaux Mixture—all rely for their efficiency in killing fungi upon the copper compounds they contain in their final chemical forms.

In addition to the copper salts there are certain sulfids or soluble compounds of sulfur and some base, such as Potassium, Calcium (Lime), etc., among our fungicides. These appear to rely not on the base nor upon the sulfur but upon the particular combination produced in the making.

Potassium sulfid solution and more latterly self-boiled lime-sulfur mixture are examples of useful sulfid sprays. Self-boiled lime-sulfur mixture of the 10-10-50 formula may be used upon the foliage of the peach without leaf injury.

The following are the formulae of these sprays as published in the spray calendar, Bulletin 199, December, 1908.

- No. 1 Bordeaux mixture.  
 Copper sulfate (blue vitriol)..... 4 lbs.  
 Quicklime (not air slaked).....4 lbs.  
 Water to make 50 gallons.
- No. 3 Ammoniacal copper carbonate.  
 Copper carbonate.....6 ounces  
 Ammonia.....about 3 pints  
 Water, 50 gallons.
- No. 7 Bordeaux mixture and iron sticker.  
 Copper sulfate (blue vitriol).....2 lbs.  
 Iron sulfate (copperas) .....4 lbs.  
 Quicklime.....6 lbs.  
 Water to make 50 gallons.
- No. 10 Self-boiled lime-sulfur mixture. (As now recommended by the originator, W. W. Scott, U. S. D. A.)  
 Stonelime.....10 lbs.  
 Flowers of sulfur.....10 lbs.  
 Water to make 50 gallons.

The effective copper compounds of the Bordeaux mixture type have a philosophy that will bear repeating. You understand how vital to the health of the leaf of any fruit tree to the crop producing power of the tree and that remedies, if applied after the leaves are injured are too late to be of high usefulness. You

understand also that an apple after it has once been attacked by apple scab can scarcely be saved to the high class merchantable apples. The more useful sprays must be of such constitution and capable of such application that the spray is continuously present during the period of infection.

The continuous attacks of apple scab in the early season must be met by the continuous presence of an active fungicide. Were we to get all the growth of new shoots and foliage on the apple as promptly as upon some other fruits, the number of sprayings to be made would be modified. As it is in fact, the sprays require to be made to meet the conditions of new leaf cluster shoots as well as those of the blossom shoots upon the new growth of the season.

The effective copper compounds in the Bordeaux mixture are those copper salts precipitated in insoluble form by the addition of lime to the solution of copper sulfate. Formerly it was held that the compound thus precipitated is copper hydroxid. Now Prof. Pickering, of England, holds that various basic sulfates of copper are produced. In either case the compounds produced and applied to the trees are relatively insoluble when applied.

Once upon the trees these become soluble by the action of the carbon dioxide and the moisture in the air and are therefore present and immediately available when such are needed to check parasitic fungi.

With Bordeaux mixture and iron sticker the same conditions hold with the added sticker qualities believed to be present and to act in such a way as to make the action more prolonged and just as effective, or very nearly so.

Formaldehyde formulae for treating potato scab, oat smut, stinking smut of wheat, onion smut, etc., as well as a formula for corrosive sublimate applied for potato scab are published likewise in the Spray Calendar, Bulletin 199.

#### APPLE BLOOM AND APPLE SETTING IN 1909

Apple blossoms were much more numerous in 1909 than the present set of fruit would lead one to infer. In southern and central Ohio especially, the failure of the trees to set fruit or even to fecundate the blossoms was apparent quite early. Specimens were received from Gallia county quite soon after blossoming. These showed that only about 5 to 7 percent of the blossoms had formed fruits. A similar state of facts held in Jackson county, in Fairfield county, and doubtless in many other districts. In the first counties named, the orchards had not borne a crop in 1908 and the trees bloomed quite freely. The fruits were not there for the apple scab to take off if it were there to do so. But these trees and many others were too much pushed to get through last season's severe drought. It would seem that the stress from the drought resulted, with non-bearing trees, in reducing the food reserves so much that not enough vigor remained to insure fecundation of the blossoms formed despite conditions. On the other hand, bearing orchards of 1908 were often so much reduced in vigor by the drought that no blossoms or next to none were formed and no fruit was set.

I know that many persons who had a fair bloom on their trees last spring were much disappointed in the crop set by the trees. The explanation seems to lie in the exhausted tree reserves from drought of 1908. This again emphasizes the very important function served by the stored food reserves in the tissues of the fruit trees and should stimulate us to orchard methods which will insure the needed reserves even in stressful times.

## SPRAY FOR APPLE FUNGI IN 1909

Plans were made for rather thorough spraying work on apples this season through the cooperation of the departments of Horticulture, Entomology and Botany. I shall speak only in relation to the Botanical side of the work so far as indications yield results now. The final results will be learned when the crops are gathered.

The weather was somewhat earlier and cooler during the apple blooming this season than in 1908, and the blossoms came earlier. However we had in most parts of the state an excess amount of showery, muggy weather before the trees were out of bloom. Indeed conditions for scab development were very favorable. The scab did not fail to get to work on the fruit where there was a chance and to attack foliage in all instances.

We planned in most spraying tests to compare Bordeaux mixture with Bordeaux mixture and Iron Sticker. At Carpenter, in addition, Self-Boiled Lime-Sulfur made a three-sided comparison.

Besides the scab the presence of an apple louse, *Aphis sorbi*, on many apple shoots complicated affairs. The secretions of these lice invited the sooty fungus and it made a very early appearance, showing about June 1 to 10 both before and after bloom.

Even the two spray treatments did not prevent all scab development upon the interior fruit clusters. However, the sprays usually saved enough fruits to tax the power of the trees to develop them on these interior clusters. Where these conditions of scabby fruit and sooty fungus were most noticeable at Chillicothe, the spraying just before the blossoms opened was rather imperfectly done and the proportion of scabby fruits was much larger than at other points where first spraying was done thoroughly. However, as the fruit crop was so disappointing in many orchards of Southern Ohio our observations were much more limited than had been planned.

In Northern Ohio, where weather conditions of last year as well as the present season have been more favorable in many ways, fine crops of apples have been saved at North Amherst and Erlin, Sandusky County and with very little scabby fruit. Detailed results are not yet available but the total outcome is satisfactory.

There is nothing to modify my judgement of one year ago, namely that spray applications of fungicides need to be made both just before the blossoms open and just after the bloom drops to insure successful results in scab prevention.

At Erlin, Sandusky County, Mr. Stokes has very fine results of scab free apples and has kept his crop this year on Winesap variety. He has used Bordeaux and Iron Sticker throughout the season, the Calendar formula 2-4-6-50 may have been partly used on early sprays but latterly and chiefly 2 lbs. copper sulfate, 2 lbs. iron sulfate and 4 lbs. lime were used. He had practically no spray injury.

The sooty fungus has apparently extended itself much less than was feared earlier. Have many of you observed recent development of a black sooty growth on the surface of the apples?

## SPRAY INJURY IN 1909.

Spray injury upon apple foliage has been very severe on some orchards in southern Ohio this season and in northern Ohio there has been little or no complaint. The difference in injury may be explained in part by the differences as to rainfall and humidity in the two sections at critical periods. At Chillicothe

and Carpenter, we had abnormal leaf injury from the sprays which in the former case may have been due to abnormal soil conditions, since the orchard became in part defoliated in 1908. Another curious fact was the much larger interval than we usually expect to transpire between the spraying and the leaf yellowing and dropping. In these experiments we used the standard formulae of Bordeaux mixture, Bordeaux mixture and iron sticker, and the self-boiled lime-sulfur mixture.

At Chillicothe, on the same varieties, notably Mann and Grimes Golden, the leaf dropping was two and a half to three times as bad as on the trees sprayed with Bordeaux as it was on adjacent rows sprayed with Bordeaux and Iron. At Carpenter, we had self-boiled lime-sulfur as a further comparison. On the trees where lime sulfur was used, scab was not quite kept down and there was little leaf fall. Where Bordeaux and iron was used there was also light or moderate leaf fall, but on the trees treated with straight Bordeaux the trees were almost entirely defoliated.

I am impressed with the possibilities of the Bordeaux and iron mixture, using slightly reduced amounts of iron sulfate, say 2 to 3 pounds to 50 gallons as an apple spray in the future, but I can not in critical cases expect much less spray injury than from Calendar Bordeaux and iron formula since it is the copper compounds that seem to be responsible for the injury to foliage.

#### SPRAYING FOR TRUCK CROP DISEASES

**Muskmelons**—In the matter of muskmelon diseases we must remember that there are two distinct types of melon diseases which are liable to be called "blights". One of these types is a true leaf or foliage disease known as leaf blight and in some seasons is supplemented by the work of downy mildew. These leaf diseases are amenable to spraying. Perhaps even more conspicuous than these are the wilt diseases of muskmelons and cucumbers, which also attack watermelons. In the wilt disease the organism attacks usually at the root of the plant and causes sudden wilting; sometimes, however, through the action of biting or sucking insects, the organism is inoculated into a branch or into the vine some distance from the root. In this case the part beyond the affection dies after sudden wilting. We really have two distinct wilt diseases. One of these is due to a wilt infesting *fusarium* and the other is due to bacterium. Both of the organisms are more likely to be found in soil where melons or cucumbers were grown the year previous. Both of them are also liable to be spread by the attacks of biting or sucking insects, such as stink bugs, leaf beetles, etc. With the wilt disease you can only gather and burn the wilted plants in order to keep down the infection. There is no spraying remedy.

In spraying for a foliage disease, and especially for the leaf spot or leaf blight of muskmelon, one needs to get at the work, as in other spraying, before the damage is done. It seems wise to spray after the vines are one or two feet long, and to keep at it throughout the remainder of the season, seeing that the vines are covered with the spray. This should be accomplished by spraying at intervals of two to two and a half weeks. The best spray seems to be Bordeaux mixture, reducing the strength to three pounds. Muskmelons are very susceptible to Bordeaux injury, or spraying injury, in seasons like the present one, and this manifests itself by yellowing of the leaves in a narrow belt around the leaf border. Perhaps some of you can call to mind conditions of this kind in your sprayed crop of melons this year. You will doubtless recall a yellowing of

leaves in sprayed melon patches, but this affects segments of the leaves around the border rim. Because of the danger of spray injury it is best to keep the strength of bordeaux for muskmelons down to the 3-3-50 formula. The 4-4-50 formula may be used without risk on cucumbers, however.

**Tomatoes**—On tomatoes, seasons like the present soon bring out a great deal of leaf spot. This leaf spot is a true fungous disease, and the dropping of the leaves shortens the crop very seriously. This was true in my own garden at Wooster the present season, but since I was attending to other people's truck patches my own had to be neglected. In your district where the growth of early tomatoes and the use of the stake method of planting is practiced, you are liable to inroads of the leaf spot fungus. However, this leaf spot fungus will tend to hasten the ripening of the fruit, and increase the yield of them, at high prices. The bordeaux mixture is a very successful spray against the leaf spot, and could be applied from the time the plants are one to two feet high until the crop is made. However, the spraying and keeping down of the leaf trouble will delay the maturity of the crop, and while the crop will be greatly increased the actual profits may not be much greater from the sprayed tomatoes than from the unsprayed ones. This seemed to be the condition more especially a few years ago when I was conducting some experiments in tomato spraying in cooperation with Mr. Chas. F. Dyer of Marietta. Possibly other conditions may have come in and I invite your impression about them.

Tomatoes are also attacked by wilt diseases of two kinds; one due to a fungous *fusarium*, and the other due to bacterium; but in both these wilts the only thing is to remove and burn the diseased plants, as with muskmelons. In the case of fruit spots, to which you are not very subject in this region, so far as I know, the bordeaux spraying will yield fine results in keeping down the decays of the ripe fruits, or of the fruits from near the time of ripening. The spraying on the other hand will not be effective in keeping down the point rot of green tomatoes, which is very liable to occur in dry seasons like last year, or if the spray will prove to be ultimately successful as yet it is only partially so. We seem to have in dry seasons a bacterial infection of the blossom end, and as yet our spraying methods have not been adapted to prevent this serious infection. At this time we can only express the need of more knowledge.

**Potatoes**—In spraying potatoes in this part of Ohio we may leave out of ordinary consideration the prevention of late blight. It is true that occasionally on wet, cold seasons, and with very late planted potatoes, we may have some late blight this far south, but this will probably not happen oftener than once in 10 or 15 years. With the early blight, on the other hand, and the predisposition in southern Ohio to periods of early summer and midsummer drought, we are very liable to have serious outbreak. Whenever these early summer conditions result in abundance of leaf sucking and leaf puncturing insects, especially flea beetles, we may count on diseases following rapidly in the wake of the insect injuries. With normal seasons, the results of potato spraying are to be expected to show a small profit value, not a large one. In abnormal seasons like 1908 thorough spraying of a crop in this region should yield a good profitable balance. You will understand the spraying is made to keep down the infections from the early blight fungus, and to prevent the collapse of the leaves in the manner described as tip burn. From the results of the last two seasons the bordeaux mixture 4-4-50 formula, and bordeaux and iron sticker of about 2-3-5-50 formula, may be safely recommended for potato spraying.

Recently in northern Ohio, starting at the Experiment Station, we have had a serious development of the potato dry rot, *Fusarium oxysporum*. Not only did this fungus kill out a small area of plants entirely in potato plots, but it is now believed to be the cause of premature dying of the larger part of the potato plots. The infection from this fungus may come either through the soil or through seed. I believe that in the present case it may have come, partly at least, through the seed, and we are just now endeavoring to make a careful field study of the trouble. The indications are that locally it is often confined to fields on particular farms throughout the northern Ohio potato region that have this premature dying of the potato tops, even where thoroughly sprayed. This will be explained by the seed infection and would not prove that spraying is without value. We wish to learn the actual state of affairs before offering much more than caution in the choice of seed at this time.

Q. We have a moderate crop of Ben Davis, with a little scab; a few Rome Beauty; the Grimes Golden are quite perfect, and no scab; they are quite free from fungus diseases. Now do they need spraying or not?"

A. "Ben Davis, Gano and Baldwin will come nearer producing a perfect crop without spraying than any others. Rome Beauty, White Pippin and Winesap are the other extreme. We did not prevent all of the apple scab by spraying in Chillicothe. I think that probably there is a different rate of development of the scab in the Grimes. I do not think that you can grow Grimes ordinarily without spraying."

Q. "How about spray injury?"

A. "Leaf injury is the more vital. Spray injury this year was a little strangely marked. Spray injury developed this year where no spraying was done. We had previously thought that it was caused exclusively by spraying, but it came to a certain extent this year where no spraying was done. There was a rusting on unsprayed trees. The injury from spraying is much less than from the apple scab. The injury from spraying might place the apples in second class, but many people say that they still sell as first-class apples."

Q. "Have you sprayed peach trees successfully?"

A. "Yes."

Q. "How much spray do you put on?"

A. "There are two features in peach spraying. All Chinese types like Elberta and Boyer are very liable to leaf curl. Spray before the blossoms open with lime-sulphur or Bordeaux mixture, for the leaf curl on the Elberta. With the Salway, Late Ware, Morris' White, and Heath Cling, spray the foliage with Bordeaux mixture, two or two and a half pounds to five, as eight pounds will



injure the foliage too much. Self-boiled Lime-Sulphur is successful as it will not injure the foliage. Use a 10-10-50 formula. This will not injure the foliage of peach trees and will give fine results. Make two or three applications."

Q. "How about summer spraying for apples?"

A. "You can prevent apple scab by using Lime-Sulfur in the summer time. This was found out in New York. Bordeaux mixture is much worse than Lime-Sulfur. If we can be as successful as the New York people were this year with Lime-Sulfur it is well worth trying. Bordeaux mixture is being used in some parts of the country with success. However, some people say it cannot be done."

Q. "Can you spray plums?"

A. "You can spray plums of the European varieties with standard Bordeaux mixture. If you spray the Japanese and American varieties at all use self-boiled Lime-Sulfur."

After dinner Mr. Selby showed apples from Carpenter. Those which had not been sprayed had much sooty fungus and scab. Those sprayed with Bordeaux mixture had a little spray injury, and there is danger of injuring next years crop through loss of foliage this year. He also showed apples sprayed with Bordeaux and Iron Sulfate, which were in excellent shape, and free from blemish. Those sprayed with Lime-Sulfur had a little scab and sooty fungus.

#### SPRAYING FOR INSECT FOES OF THE ORCHARDIST

By H. A. GOSSARD, Ohio Experiment Station

Ladies and Gentlemen:—The orchard in which we are assembled represents a part of a general orchard plan entered into by the departments of horticulture, botany and entomology of the Experiment Station for the purpose of demonstrating that Ohio can grow apples in competition with any other parts of the United States. More or less experimental work in orchard spraying has been done by the Experiment Station throughout the period of its history, but one of the notable experiments in spraying was conducted by the Department of Entomology in the orchard of the Messrs. Schmitkons of Lorain in 1907. This orchard comprises about 25 acres of trees, something like 20 feet tall, with an equal spread of limbs. The principal varieties represented in the orchard are Baldwin and Ben Davis, but 25 or 30 different varieties are grown. During the season of 1907 the gross return for the crop was somewhere in the neighborhood of \$4500 while the cost of treatment was less than \$200. The spraying was done with a gasoline power sprayer having a 250 gallon tank and a tower built over the trucks so that one of the operators standing on the tower would have his feet elevated 5 or 6 feet above the ground and with a bamboo pole 10 feet long was enabled to reach into the tops of these trees very conveniently. At the end of the rods were used some goose-neck crooks made by bending gas pipe at

an angle of 15 to 20 degrees. Most of the spraying companies now make these crooks, or at least angled nozzles. However, they can be made by the local blacksmith from 3 or 4 inches of gas pipe threaded at each end; one end to screw into the end of the extension rod and the other to fit into the nozzle. When the rod is extended at something of an angle, the additional angle given by the crook throws the spray downward and into the cups of the bloom. When apples first bloom the flower end is turned skyward and the apple remains in this position for about ten days or two weeks after the petals fall. Since about 90 percent of all the codling worms enter the apples through the calyx cup it is very essential that a goodly amount of poison be driven into the flower ends of the apples so as to destroy the worms when they take their first meal. It is also desirable that considerable power be employed to drive this spray to the desired location. From 100 to 150 pounds pressure is advisable, but good results can be obtained with lower pressure provided the operator is persistent enough to remain at the same tree until it is fully covered. Upon all these trees we used from 10 to 15 gallons of spray for the first spraying after bloom. The greater part of the orchard was sprayed with Bordeaux mixture in combination with arsenate of lead. The first spraying had 4 pounds of copper sulfate, 6 pounds of lime and 3 pounds of arsenate of lead. For the second spraying about two weeks after bloom the copper sulfate was reduced to two pounds and a considerable part of the orchard was not sprayed in this second treatment. A third spraying with arsenate of lead alone, using three pounds to 50 gallons of water, was given in the latter part of July to some of the plots. There was considerable injury from Bordeaux burning both on fruit and foliage. However, the apples ripened up quite satisfactorily through the russeted skins, and the fruit was first class at harvest time though, of course, it would not go as fancy fruit. However, there was no difficulty in disposing of it at \$3.50 per barrel, and a great many barrels were disposed of locally at \$1.50 per barrel. During 1908 we transferred our operations to an orchard of about 14 acres located a few miles from Fremont in Sandusky county. This orchard is the property of Mr. J. A. Stokes and the trees in one of the 4 acre blocks were about 22 years old, in another 4 acre block about 20 years old and in another from 12 to 15 years old. There were two acres of very old trees—40 to 50 years. We likewise used a power sprayer here. Owing to the great size of the trees we were not able to reach the tops of them so satisfactorily as in the Schmitkons' orchard. However, by putting on a brass extension of three or four feet to the end of the 10 foot pole, we succeeded in covering the tops of most of the trees. We used weaker mixtures in this orchard than the preceding year, the principal formula being 2 pounds of copper sulfate, 3 pounds of lime, and 3 pounds of arsenate of lead to each 50 gallons of spray. On some of the plots arsenate of lead alone was used at the bloom, and then a fungicidal application was given 10 days or 2 weeks later. The fungicides used for this purpose were Bordeaux mixture, self-boiled lime-sulfur made with cold water, and commercial lime-sulfur. The fungicidal applications were a little too late, we think, to give best results and some scab developed on all the trees that were left until the second spraying for the application of fungicide. Very little scab developed upon the Ben Davis and Baldwin trees that were treated with Bordeaux immediately after bloom, but was quite conspicuous upon the Winesaps and a few other varieties especially susceptible to scab.

The orchard had been sprayed very thoroughly with lime-sulfur wash just as the buds were swelling and this doubtless contributed very much to hold the scab in check. There was practically no burning of fruit in this orchard, but

the weather was almost ideal for spraying at the time the application was made. From this 14 acres of orchard the gross receipts for the crop of 1908 was \$7,400. A single acre of Ben Davis trees yielded about \$1,408 gross, or more than \$1,000 net. The trees for this acre were not selected in any way, but every tree in the block was counted whether it had on it few apples or many. During the present season the Department of Entomology has had a number of different orchards located in different quarters of the state, under treatment. One of them is the Schmitkons' orchard, already mentioned; another is the Stokes' orchard, which gave a heavy crop in 1908; another is located at Mantua in Portage county; one is in Gallia county; another in Jackson county: then we are using the Station orchard at Wooster; also a small family orchard of three or four acres near Wooster. The orchard at Mantua has been defoliated by canker worms a number of seasons, and we therefore anticipate a light crop upon it this year, but see no reason why it should not give a good return next season. The orchards in Gallia and Jackson counties suffered so severely from drouth last year that they did not have sufficient vitality to hold their crops this year, though they bloomed heavily. We are confident that they will produce a good crop next season unless frosts or something of that character intervene. It is our desire to carry on experiments in all these orchards through a period of years so that we may strike an average and know what we can reasonably expect from Ohio orchards.

The greatest consideration in spraying apples is to be sure that enough liquid is applied. Do not be afraid of wasting a little spray. It is not wasted, even if it does run off on the ground. The old idea of employing a mist spray and ceasing the application before dripping begins, is not so successful as a heavy application. I believe there is less burning of foliage when the trees are sprayed until they drip, because in that case the leaves are bathed with the spray, all of the spores of disease are thus destroyed, and instead of the drops collecting on the bottom sides of the leaves, remaining there and burning the edge of the leaf, they roll onto the ground, leaving a comparatively small amount of spray adhering to the lower edge of the leaf. I prefer making the spray very weak and using an abundance of it. Trees such as you see around you, will need from 10 to 15 gallons of spray, depending upon their size, for the first spraying after bloom. If this spraying is thoroughly made the crop for the year is practically insured whether or not any additional applications are given, though it is advisable in many cases to give a second and oftentimes a midsummer application. If growing fancy apples, it may be necessary to spray even oftener, but good salable apples, free from worms, can be obtained in the manner I have described. For southern Ohio and for varieties of apples that are particularly susceptible to scab, I presume it is the part of wisdom to spray with Bordeaux mixture after the leaves appear and before the trees are in bloom. If a very thorough spraying is done with lime-sulfur just when the buds are opening I am inclined to believe that some varieties in the great majority of seasons will need no spraying with Bordeaux until after the bloom falls.

Regarding the question of pumps, orchards of six acres and upward should have a power sprayer of some description. Personally, I prefer a gasoline engine as a source of power, but traction sprayers and compressed air sprayers are adapted to certain uses and of course deserve consideration. For orchards of 4 to 6 acres, powerful hand pumps or power hand pumps, capable of maintaining a pressure of 80 to 100 pounds without overworking the man at the pump

handle, are desirable. For smaller orchards barrel pumps are used, but where there are only from one to a half dozen trees, bucket pumps may be used, though they are somewhat inconvenient for such use.

It will cost from 25 to 50 cents per season to spray one tree of the average size shown in this orchard. Such trees ought to give from 8 to 15 bushels of apples each, and since they produce very little if unsprayed, it is readily seen that the profit from spraying each tree will range from 5 to 12 dollars if apples bring in the neighborhood of one dollar per bushel. Since our population has increased so much in late years, while the orchard area all over the country has decreased owing to the ravages of the San Jose scale etc., it will pay every owner of apple trees, whether he has one tree or many acres of orchard, to take good care of them. In fact, there is no part of the farm that will pay a higher dividend on care and attention than the apple orchard.

Q. "Do you use arsenate of lead with Bordeaux mixture?"

A. "Yes. We use it with Bordeaux mixture. It is all right."

Q. "Why does Mr. Gossard prefer arsenate of lead, at 10 cents per pound, instead of Paris green, at 30 cents per pound?"

A. "Arsenate of lead kills more worms than Paris green, and sticks on the trees much longer. The extra cost of arsenate of lead is much more than paid for by the larger crop."

Q. "How much spray mixture do you apply at a spraying?"

A. "Ten or twelve gallons at an application after blooming."

Q. "But will it not run off the leaves? I only use about three or four gallons. Is more necessary?"

A. "It will drip, but let it keep on dripping. My observations lead me to believe that when only enough spray is put on to stick that it sticks on the leaves in drops and is likely to burn holes in the leaves. When it runs off the leaves are freer of fungus and there is less liability of leaf injury."

Q. "What is the cost of spraying trees the size of these (30 years old), three times each?"

A. "I think that it costs about 40 cents or 50 cents per tree for a season's spraying. Possibly a little more."

Q. "What is the trouble when peach trees live one or two years and then die? What is the matter?"

A. "It might be borers, but I could not say without seeing the trees. It might be yellows or some other cause."

Q. "How do you get rid of the borers?"

A. "The borers are caused by a moth that lays its eggs in the bark of the tree near the base of the trunk. If you have only a few trees dig out the worms with a knife and kill them. It may help to spray with Lime-Sulfur. Bank the trees to a height of eighteen inches with earth and leave it until the first of October and then

remove it and give the trees a chance to harden up before winter. This will make the moths go higher up on the trunk to deposit the eggs. By running a wire into the holes where the borers are you will likely kill some of them."

Q. "What do you do for bitter rot?"

A. "That belongs to Mr. Selby."

Professor Selby: The bitter rot spray has to be applied after the other applications. If you are treating for the bitter rot follow up the spraying for the codling moth, rot and scab with two or three applications of ammoniacal copper carbonate as described in the spray calendar. This will not injure the salability of the fruit, as Bordeaux mixture will. Mr. Cox says that Bordeaux mixture will not injure the salability of the fruit, but our conditions are farther north than Mr. Cox's.

Q. It has been difficult for me to save my Smith Cider for the past three years. We had the brown rot, which comes in as ripening time approaches. It is light brown to black in color; what is the remedy?

A. There are two rots, the brown and the bitter rot. They have very much the same appearance, being small, circular depressions, but the brown rot is a lighter color than the bitter rot. The bitter rot is usually a very dark color, nearly black, while the brown rot is a comparatively light brown. If you taste an apple that has an advanced stage of the bitter rot, you get a decided bitter taste. If you taste an apple with the brown rot the bitter taste is not noticeable. The treatment is given fully in the spray calendar, bulletin 199, of the Experiment Station.

Q. Has the Station tried a preparation called "Scalecide"?

A. Yes. We have used it. It is a good remedy for the San Jose scale.

Q. Can you use it in the fall?

A. It may be. It is used in the fall pretty generally over the United States without any bad results. I think it is all right.

Q. What can you do for pear blight?

A. There is no satisfactory remedy for pear blight. Perhaps Mr. Selby can tell us more about it.

Mr. Selby: I do not think that any man can grow certain varieties. I do not think that any living man can succeed with Flemish Beauty or the Bartlett in this region. Most people in this region can succeed with the Summer Sugar Pear or the Seckel, which seem almost immune from blight. Least, probably the Keiffer. Next and in the same class will come the Duchess, Sheldon and possibly the Anjou.

The blight is produced by a bacteria which lives over on the blighted wood. At the time when the pears bloom this bacteria secretes a substance from the spores. The bees visit this secretion, and then go to the blossoms, and the fungus develops in the nectar and pollen of the blossom.

Use Lime-Sulfur spray and cover the trunk of the tree. There is no specific remedy for pear blight. Cut off the blighted wood and burn it. It may be cut off now, but be sure and do it again before the trees bloom in April.

Q. Can grape rot be controlled?

A. We have handled all of the commercial varieties and grown them successfully. The treatment is all boiled down in the spray calendar, and the results are all shown in the bulletin of the Station "Spraying For Grape Rot". Get to all the new clusters before the blossoms open; otherwise the black rot fungus will get ahead of you; then spray after the blossoms fall.

With regard to the Norton Seedling will say that as it is a special case it requires special investigation to solve it.

Q. Why is it that some varieties do much better on the side of a building than they do on a trellis?

A. The explanation probably lies in the fact that when they are on a building there is less opportunity for moisture to collect on the clusters of grapes, thus affording less opportunity for the fungus to work on them.

#### APPLE GROWING IN SOUTHERN OHIO

By U. T. COX, Proctorville

At the New York State Fair I saw results of spraying with the lime-sulfur solution, a commercial brand, for apple scab and there was no russetting of the fruit at all and where sprayed with the Bordeaux it was very rusty and some of it deformed. It seemed to be a better spray than Bordeaux as they used it, giving as good results in preventing scab with no injurious effects. They added arsenate of lead for the codling moth with good results, notwithstanding Mr. Gossard saying it will not do. As he has strongly urged thorough work in spraying I want to emphasize the fact and add that if three men are to run a hand spraying outfit I advise putting two of them on the pump handle and one to hold the nozzle. Two men can give good pressure and one can not, and under high pressure the liquid will be discharged as fast from one nozzle as from two with ordinary pressure and it will spread better and do much more effective work than with low pressure. A power sprayer is the only thing for effective spraying if one has enough orchard to justify such an outfit. It does not require a very large orchard for one machine to pay for itself either. In the west they have an outfit for every 10, 15 or 20 acres of bearing orchard and I would suggest getting a good outfit if one had five acres of good apples, or less if the right man has it and the right kind of fruit.

If we go into a community where there are plenty of orchards that are well taken care of they have plenty of buyers for the fruit and as competition is the life of trade the fruit brings better prices; and as fruit from any certain locality where it is well grown and packed, and graded honestly, brings better prices in the markets, the buyers want such for the trade and they can sell it to better advantage than that from unknown parties, or from localities not known as apple sections. I understand Mr. Oakes has sold his crop at \$3.50 per barrel and if there were plenty more orchards around here that had been well sprayed and had good fruit he would likely have sold them for \$4.00 per barrel. As he has only just begun spraying and demonstrated that apples can be grown here successfully, even when he did not do a thorough job as we can see by the looks of the tops of the trees where the spray did not reach and the foliage is not the best, and some of the fruit scabby where they get the best fruit from unsprayed trees, so we may conclude that with better appliances and better work they can grow apples here that will compare favorably with those grown in the far west if we give the trees the attention they do out there. I feel certain that if this orchard had been sprayed another time late in the season, the last of July or first of August, for the late brood of the codling moth and leaf troubles that the fruit and foliage would be found sticking better.

On the hills generally we must do something with the orchards besides cultivating, and the sod mulch seems to be the best plan; it works well even in the bottoms, but then one must mulch instead of mowing the grass and taking it off as hay. One can cultivate if he wishes on land that will permit it, but I am in favor of mulching if properly done to conserve moisture and make fertility available.

Q. How far apart do you plant Rome Beauties?

A. Thirty to thirty-five feet on soil like this. (First bottom, Ohio river.) In the hills plant them twenty-five to thirty feet apart. Plant the rows around with the curvature of the hill, so that you can drive around the rows. Do not plant the rows up and down the hills. Plant the trees a little closer together in the rows than the distance between the rows. Say have the trees twenty-five feet apart in the rows and the rows thirty feet apart. If possible set the trees out in grass, as I think this will give the best results. I would recommend setting trees twenty-five by thirty instead of fifty or sixty by thirty. Set the trees fairly close on the hill land, as it will protect the soil and keep more moisture in the ground than if the trees were planted farther apart.

Q. Would not the evaporation from the trees be greater than the evaporation from the ground if the trees were planted farther apart?

A. It might be. That is a matter that must be found out by experimenting; but I would recommend planting the trees closer together.

Q. What would you do with trees where possibly one third of the branches are dead?

A. Trim up the trees, and try to get water-sprouts to fill up the vacant spaces.

Q. Do you cut the limbs off close to the trunk or leave a stub?

A. Cut the limbs close to the trunk is my advice. Some people say to leave a stub, but I would cut close to the trunk and then paint the wound.

Q. Do you spray for the foliage, and what do you use?

A. I do spray for the foliage. I think it makes the leaves stay on the trees longer, which causes the apples to stick on the trees longer, ripen up better and color up better. I spray from the middle to the last of July and use diluted Bordeaux mixture. About two to three pounds of blue vitrol to four or five pounds of lime, and a little arsenate of lead to the fifty gallons of water.

Q. Will it do to prune trees at any time in the year?

A. I prefer to do my pruning in the spring. When you cut the limbs off in the fall they check and crack badly if not painted. Pruning a tree in Summer when it is growing too fast may bring it into bearing earlier. I like to see the limbs down close to the ground. They may just as well be down to within a few feet of the ground, and bearing apples, as to have a vacant space there.

Q. Can you keep sheep in the orchard?

A. Keep the sheep out. If you want an orchard get rid of the sheep.

Q. How can you get rid of the rabbits in the orchard?

A. I keep the weeds and grass down in my orchard and am not troubled much with them. If I was I would kill them, or if I could not kill them myself I would hire someone to kill them for me. You can kill them, trap them, or place wire screens around the trees for protection.

Q. What are some good apples?

A. Grimes Golden and Jonathan for earlier varieties, and Rome Beauty and Rawles Janet for winter apples.

Q. How about the Ensee apple?

A. It has a fine quality, good size. The young trees bear when five or six years old. I believe that it is worthy of a trial. See that it is tested before you go into a new variety or you will get bit ninety-nine times out of one hundred.

Q. How about the winter Banana?

A. A fairly good apple. I would not advise anyone to put out an orchard of it. Do not go farther before experimenting with it.

Q. What of Stayman Winesap?

A. I do not know what it will do.

Q. What do you think of the Delicious?



A. Tastes real well. There are better for this region. Some in the Ohio valley are doing well. It is a fall apple here.

Q. What of the Hubbardston?

A. Too far south for it, I think. I do not think I would plant an orchard of it at present until I knew more about it. Too much of a fall apple.

Q. In spraying, some people use a pole with the fluid going through the pole. Others use a pole with the hose fastened to it. Which is best? It makes me tired to hold up a pole, with the hose fastened to it, for a day at a time.

A. By all means get a bamboo pole lined with brass or even aluminum, though that costs more, I believe. It is much lighter.

Chairman Waid said he thought they ought to hear from Mr. Ballou, who had charge of the spraying work in the orchard they had been inspecting.

Mr. Ballou said that the orchard had been sprayed to some extent before Mr. Oakes had told him that he sprayed quite differently from the way it was sprayed this year. In fact, he had sprayed very indifferently in comparison with the way it was sprayed this year.

Q. How much spray did you use to a tree, and what was the cost?

A. It ran from seven to eight gallons to a tree at each spraying. The cost of spraying the trees was from 25 cents to 30 cents per tree for three applications each. About 10 cents per tree for each spraying. This is for the material alone. The labor would be extra.

Q. Why are some of the apples here dropping so much?

A. Some of the apples were not sprayed. The apples in our sprayed plot have been dropping very little.

Chairman Waid then called upon Mr. Oakes, the owner of the orchard, for a few remarks.

Mr. Oakes stated that he had been fully converted to the spraying business. Last year he went through the orchard and found one little, knotty apple. He intended to grub out the entire orchard as soon as he could find a market for the timber. Last spring Mr. Ballou came around and asked him what seemed to be the trouble with the orchard. He told him that he thought it was the cold weather in the spring, which prevented the apples getting enough sap to develop. Mr. Ballou said he thought he could help things, a little; and, Mr. Oakes said, "you can look around and see the results. I am sorry now that Mr. Ballou did not get after me with a little hickory oil and make me get up into the trees and spray all of them

thoroughly. This orchard is past what I used to believe to be the age limit of a Rome Beauty orchard—thirty years. I now think that I can make it last as long as I live.”

Q. What will you do with your orchard now?

A. I propose to go through the orchard, thin out and trim up the trees, and if possible mulch them. I will not cultivate the orchard.

#### A MESSAGE FROM THE NORTH

By W. W. FARNSWORTH, Waterville

Whenever a body of men of kindred tastes, and following the same or similar avocations, come together for an interchange of experiences, great benefits are sure to follow.

Life is too short for the Horticulturist to secure the information necessary for the highest success through his own experience, and he who attempts it will find old age creeping on him before he has well mastered the rudiments.

The wise fruit grower is he who avails himself of the light which science and practise can give him, and by careful observation adapts these deductions to his individual needs.

Commercial and Domestic Horticulture have undergone great changes in the last score of years.

Twenty years ago nearly every farmer grew his own supply of fruit and usually had a surplus, which was thrown upon the market in any condition, in any package, at any price.

Unfortunately for the grower for home use only, but fortunately for the professional grower, these conditions have radically changed. The increased number of insect and fungous enemies and especially the advent of what Hale calls “That blessed San Jose scale” has given the field into the hands of the professional grower who is willing and able to equip himself with the necessary knowledge and appliances, and who will make a study of the business and make all others secondary or contributory.

One thing which has greatly retarded the progress of fruit growing, has been a tendency to copy blindly the methods of others or to follow dogmatic rules formulated by other fruit growers more or less successful.

We may and should learn much from others, but all plans and recommendations must be tested carefully and thoughtfully under our own conditions before being accepted as being applicable to our needs.

Prof. Roberts of Cornell when asked if certain dairy practices were commendable replied, ask the cow. And so when in doubt as to the wisdom of any contemplated method let us ask the trees.

In other words we must be close students and observers of our own business.

We can not lay down any ironclad rule of management which will apply to fruit trees under all conditions.

We must study the requirements of the tree.

Ask the tree what it requires and read its answer in the manner in which it responds to different treatments.

I believe there is a bright outlook for the Horticulturist in any part of Ohio who will push his business, and I believe that much of southeastern Ohio is particularly adapted to fruit growing.

A proper location is essential, but the proper man is even more so.

There are probably more fruit locations than fruit men.

To attain the highest measure of success and at the same time enjoy the greatest measure of satisfaction, we must like the business.

There are many little details which go to make the perfect orchard, and these will be attended to, only if we look upon each tree as a personal friend and acquaintance.

Individual practises in pruning have blazed a fairly plain trail which we may follow while studying how to do better, and observing the effects of different methods.

The science of spraying while yet in its infancy, has reached that stage where we stand on firm ground while we advance farther.

In the matter of feeding the tree, but little advance has been made because dame Nature has attended to that part of the work with but little of our help.

It is high time for us to begin to cooperate with her however. Nature produces fruits unaided, but with man's assistance she produces much better crops of much better fruits.

We should study the requirements of the tree and aim to secure the necessary food and moisture, by those means which under our conditions, will accomplish the end in the cheapest and most effective manner.

We can not say that all must cultivate, neither can we say that all should mulch. Conditions must govern.

Possibly the most general rule which can be given, is that all must spray, and spray thoroughly, if they wish to succeed.

But we can not say that all shall spray alike or that the same grower should spray two seasons alike.

The fruit grower on the "Sun Kissed" hills of Ohio must face the problem of moisture and fertility in a different manner from which we meet it on our stronger level lands.

The amount of fertility required to produce a dollar's worth of fruit, is much less however than that required to produce a dollar's worth of grain.

The necessary humus must usually be grown either in the orchard itself or on land adjoining.

Probably this will need to be supplemented by the use of commercial fertilizers although in some instances, the addition of sufficient humus, may render available a sufficient amount of the mineral elements already in the soil. A safe rule for the novice is to adopt the practises of the most successful growers, whose conditions are similar, and then not follow them blindly, but search out the reason for everything and always try to improve. Then the question of marketing the fruit is of great importance. People are more particular about the quality of their fruits than of most other products. While a bushel of the finest wheat may not sell in the market for more than 25 to 30 percent more than a bushel of number 3 yet a bushel of fancy peaches will bring three or four times as much as a bushel of the third grade. The masses are coming to recognize fruit as a luxurious necessity and want it not only of good quality but attractive in appearance, and he who places on the market just such an article as he himself would like to buy were he purchasing, will have no trouble in getting and keeping customers. The manner of marketing as well as the varieties to plant will depend upon conditions. If you have good shipping facilities to a good market and are making fruit growing your main business, you will do well to plant a succession of varieties and arrange to supply grocers

or consumers during the entire season, thus securing a good trade and distributing the labor of harvesting and marketing over a long season. If however you have not these advantages, or if fruit growing is but a side issue with you, you will do better to grow but few varieties and sell at wholesale.

To recapitulate. Don't go into the fruit business simply because you think there is money in it. You must love it to succeed. Take a personal interest in every tree and plant. Cooperate with nature to feed and water the tree in the cheapest way you can and still secure the greatest possible amount of fine fruit, for the largest number of years. Prune intelligently or in other words be able to give a reason for every limb you cut off. Spray diligently and know what every application is for and examine carefully to see if it accomplishes the desired end.

Do not plan too large an acreage. Market in accordance with the Golden rule and remember that a pleased customer is the best advertisement.